TO: T10 Membership
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SUBJECT: T10/03-319r1, ADT Transfer Ready IU / Response IU Race Condition

1. Revisions

Rev.1:

Incorporated changes from 20 October 2003 teleconference. See minutes, T10/03-341r0, discussion item e. Differences from changes suggested in the minutes are:

- Rather than defining I_T Nexus Loss, specified the occurrence of Port Login or Port Logout.

- Defined negotiation exchange lifetimes in terms of transitions among negotiation states, which are already defined in terms of IU transmission and reception.

Rev. 0:

Initial proposal

1. Summary

We have identified a possible race condition in a data-in command. The problem can arise when the initiator port requests more data in a command than the target port wishes to send. Furthermore, the last data-in IU sent by the target port satisfies the amount of data requested by the most recent Transfer Ready IU sent by the initiator port:

```
Initiator Port                         Target Port

SCSI Request IU ----------------->
    buffer allocation length = 9k
    first burst length = 4 k
                                       (target has only 8k to send)
        <------------------------- SCSI Data IU (2k)
        <------------------------- SCSI Data IU (2k)
Xfer Rdy IU (4k)----------------->
        <------------------------- SCSI Data IU (2k)
        <------------------------- SCSI Data IU (2k)
Xfer Rdy IU (1k) ----> RACE <------ SCSI Response IU (GOOD Status)
```

As shown, the initiator port does not know that the target port will send more data, so it sends a Transfer Ready IU. The target port, having no more data-in to send, chooses to send a Response IU. The race can actually occur anywhere on the physical medium or in the protocol stacks of the initiator or the target.

This problem can be solved by specifying a solution to a more general problem, i.e., what to do with IUs that aren't a part of an existing exchange (and which don't start a new exchange).

2. Proposed Solution

A port receiving any of the following IUs outside of an open exchange will transmit an ACK IU and discard the IU:

- Port Login IU with the ACCEPT bit set to one
- SCSI Response
- SCSI Transfer Ready
- SCSI Data

- VHF Data

Definitions of exchange lifetimes are given below.

3. Proposed Changes

Make the following changes to Table 15, NAK IU status code values:

Status Code	Description	Retryable
09h	Invalid exchange ID	Y
0Ah – 2Fh	Reserved	N/a

Insert the following new subclause after subclause 6.5.8:

6.5.9   Link service exchange lifetime

Link service exchanges may be negotiation exchanges, port logout exchanges, pause exchanges, or NOP exchanges. Port logout IUs, Pause IUs, and NOP IUs are sent in single-IU exchanges. A single-IU exchange becomes active in the sending node with the transmission of the IU and inactive with the reception of the Acknowledgement IU. A single-IU exchange becomes active in the receiving node with the reception of a valid IU and inactive with the transmission of the Acknowledgement IU.

A negotiation exchange becomes active in a port when the port enters N0:Initiate state. A negotiation exchange becomes inactive in a port after the port transitions out of either N2:Accept state or N3:Complete state.

If a port receives a Port Login IU with the ACCEPT bit set to one in an inactive exchange, it shall transmit a NAK IU with a status of Invalid exchange ID and discard the Port Login IU.

Insert the following new subclause after subclause 7.1.5:

7.1.6   SCSI exchange lifetime

A SCSI encapsulation exchange becomes active in an initiator port after the port transmits a SCSI Request IU and receives an ACK IU for it. A SCSI encapsulation exchange becomes active in a target port after the port receives a valid SCSI Request IU and transmits an ACK IU for it.

A SCSI encapsulation exchange becomes inactive in an initiator port after:
1) the port receives a SCSI Response IU for that exchange and transmits an ACK IU for it;
2) the port transmits a SCSI Request IU containing a task management request terminating the exchange, receives a SCSI Response IU with a RESPONSE CODE of Command or task management function complete for the task management request, and transmits an ACK IU for it;
3) a Port Logout occurs; or
4) a Port Login occurs.

A SCSI encapsulation exchange becomes inactive in a target port after:
1) the port transmits a SCSI Response IU for that exchange and receives an ACK IU for it;
2) the port receives a SCSI Request IU containing a task management request terminating the exchange, transmits a SCSI Response IU with a RESPONSE CODE of Command or task management function complete for the task management request, and receives an ACK IU for it;
3) a hard reset occurs;
4) a Port Logout occurs; or

   5)   a Port Login occurs.

If a port receives a SCSI Response IU, SCSI Transfer Ready IU, or SCSI Data IU in an inactive exchange, it shall transmit a NAK IU with a status of Invalid exchange ID and discard the SCSI IU.

Insert the following new subclause after subclause 7.2.6:

7.2.7   ADC fast access exchange lifetime

ADC fast access exchanges may be either VHF data exchanges or AER control exchanges. AER IUs are sent in single-IU exchanges. A single-IU exchange becomes active in the sending node with the transmission of the IU and inactive with the reception of an ACK IU. A single-IU exchange becomes active in the receiving node with the reception of a valid IU and inactive with the transmission of an ACK IU.

An ADC VHF data exchange becomes active in an initiator port after the port transmits a Request for VHF Data IU and receives an ACK IU for it. An ADC fast access exchange becomes active in a target port after the port receives a Request for VHF Data IU and transmits an ACK IU for it.

An ADC VHF data exchange becomes inactive in an initiator port after the port receives a VHF Data IU for the exchange and transmits an ACK IU for it. An ADC fast access exchange becomes inactive in a target port after the port transmits a VHF Data IU for the exchange and receives an ACK IU for it.

If a port receives an ADC VHF Data IU in an inactive exchange, it shall a NAK IU with a status of Invalid exchange ID and discard the ADC VHF Data IU.

An ADC AER control exchange becomes active in an automation port after the port transmits an AER Control IU and receives an ACK IU for it. An ADC AER control exchange becomes active in a DTD port after the port receives an AER Control IU and transmits an ACK IU for it.

An ADC AER control exchange becomes inactive in an automation port after the port receives an AER Control IU and transmits an ACK IU for it. An ADC AER control exchange becomes inactive in a target port after the port transmits an AER Control IU and receives an ACK IU for it.

If an automation port receives an AER Control IU in an inactive exchange, it shall transmit a NAK IU with a status of Invalid exchange ID and discard the AER Control IU.